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Highlights

- Bangkok residents were willing to pay USD42 per year to improve Bang Kachao's ecosystem services.
- Clean air is the most important service, followed by food, recreation, and bird diversity.
- The government needs to take proactive steps to promote agroforestry and ecotourism in Bang Kachao.
- A PES scheme might be implemented to ensure ecosystem service provision in Bang Kachao.

1. Introduction

Green areas are important to urban residents as they deliver significant ecosystem services including clean air, water regulation, food and agricultural products, biodiversity protection, and cultural services (Millennium Ecosystem Assessment, 2005). Trees and forests in urban areas provide various services to the environments and citizens value the natural amenities that trees provide (Dwyer et al., 1991). Lee et al., (2016) confirm that people are influenced by both economic conditions and residential conditions, especially natural amenity variables when choosing to move into or remain in an area.

Bang Kachao is the largest green area in Bangkok, the capital city of Thailand. Hence, it is a major source of oxygen, which can reduce air pollution in the metropolitan area. As a large area of Bang Kachao is covered with a rich biodiversity of trees, herbaceous plants and food crops, it offers various provisioning services to community members (Ljubas et al., 2017). Another benefit provided by this green area is cultural service, especially the Sri Nakhon Khuean Khan Park, which was created as a green space for recreational users. The park and the Bang Kachao's greenery are well known for both Thai and international tourists, which in turn could bring about additional income for local communities (Sukawattanavijit and Pricharchon, 2015). Thus, the Bang Kachao Green Area has contributed to the wellbeing of local communities and Bangkok citizens.

However, rapid urbanization and land-use change has been a major diver to the loss of agricultural land and forested areas of Bang Kachao. As a gradual increase in land prices,

traditional mixed orchards have been transformed into over-populated warehouses. Local people have left their farmland and migrated to work in the capital city (Sukawattanavijit and Pricharchon, 2015). Moreover, because the ecosystem services in Bang Kachao are provided free of charge, in forms of public goods, therefore policymakers typically ignore the value of these services. This has resulted in a market failure, which is difficult to achieve socially optimal services because of over-consumption and negative externalities. Consequently, the reduction of green areas has been continued, causing social disorder, including pollution and health problems.

To assign a monetary value to the ecosystem services under the concept of non-market valuation suggests a potential solution because it allows us to assess the tradeoffs inherent in developing human societies within ecological systems. The monetary value can be used to support policy decisions in a number of ways. First, it provides a common unit of comparison between benefits and costs when choosing optimal policy options. Second, value assessment helps policymakers to quantify the environmental impact in monetary terms and inform planning and budgeting of the project. In addition, the willingness to pay value of ecosystem services can be useful for evaluating the feasibility of a payments for ecosystem services (PES) scheme to guarantee the quality of ecosystem services. For instance, it is important to know whether the price service providers demand a match with the offers of the buyers (Wunder, 2007).

In economic literature, although a series of non-market valuation techniques have been used to estimate the monetary value of ecosystem services, interest in stated preference approaches, which rely on preferences or values as stated by individuals, has been increasing (Tisdell, 2005). The major advantage of the stated preference approaches is that they are capable of valuing both use and non-use values (Hanley and Spash, 1993; Tunstall and Coker, 1996). There are two methods that are widely used under the stated preference approach: contingent valuation and choice experiments. The contingent valuation method would be used to estimate the total change in an environmental good, while the choice experiment is capable of valuing multidimensional environmental changes (Pearce et al., 2006). Thus, the choice experiment method allows the estimation of the relative importance of multiple environmental attributes and their levels (Seenprachawong, 2016). Christie et al. (2004) also state that public preferences for different attributes of biodiversity and ecosystem services can be of much assistance in guiding the design of environmental restoration policies. Hence, environmental economists have been increasingly interested in the choice experiment method.

Several recent studies (Calleja et al., 2017; Tran et al., 2017; Sirina et al., 2017) have estimated the willingness to pay for improving ecosystem service provided by urban green spaces using contingent valuation method, whereas other studies used choice experiments to

explore preferences over various urban forest attributes and green infrastructure in developed countries (Koo et al., 2013; Fruth et al., 2019). However, there is a gap in the literature on using the choice experiment to investigate people's preferences and willingness to pay for urban forest ecosystem services in Thailand because only a small number of economic valuation studies have been conducted to estimate the value of urban forest resources in the country. For example, Yotapakdee et al. (2019) have evaluated the monetary value of the benefits of the big trees in Bang Kachao by calculating the market value of the available timber, and carbon credits. Another example is the recent study that focuses on valuing the total benefits of Yang Na, a plant species, in an urban area using the contingent valuation method (Saengarwut et al., 2018). Nevertheless, the choice experiment method has not been applied to the context of urban forests in Thailand. This study, in particular, has an emphasis on whether the choice experiment technique can be applied to obtain information associated with Thai people's preferences over various types of ecosystem services provided by an urban forest.

The objective of this study is to examine the preferences and willingness to pay (WTP) of residents in the Bangkok metropolitan area for enhancing the ecosystem services provided by the Bang Kachao Green Area through a choice experiment design. In this study, we identify factors influencing the estimated WTP and explore how important each ecosystem service attribute is in driving decisions regarding the WTP and which levels within each attribute are preferred. We expect to provide useful information for policymakers on designing community-supported strategies and to aid the design and implementation of PES schemes for enhancing ecosystem services in the Bang Kachao Green Area and other urban forest areas, especially in developing countries.

This paper is organized as follows. In the next section, we introduce the concept of non-market valuation, especially the choice experiment method, as well as the economic and econometric models. Then, in the method section, we describe the study area and the four steps in the choice experiment survey, including the model and welfare estimation. This is followed by the results. In the final section, we discuss the findings and conclude on the policy implications.

2. Non-market valuation through choice experiment

2.1 Non-market valuation methods

Natural ecosystems provide not only services that have value in the market but also non-market-value benefits. Because the benefits and costs of environmental consumption are usually non-market in nature, a series of non-market valuation techniques are used to estimate these types of

outcomes. The methods for measuring these economic values are the revealed and stated preference approaches, which measure the increase or decrease in the utility or economic value of environmental changes for individuals. The revealed preference approach uses tangible market transactions to assess preferences regarding the environment, such as house prices, and relies on observed behavior. In other words, this approach infers people's WTP to obtain a specified good by observing behaviors in regular market places. The hedonic price and travel cost methods belong to this category. Although the revealed preference approaches are defendable, they are not applicable to non-use valuation. Interest in the stated preference approach, which relies on preferences or values as stated by individuals, has been increasing (Tisdell, 2005). In theory, the major advantage of stated preference over revealed preference methods is that they are capable of valuing both use and non-use values (Hanley and Spash, 1993; Tunstall and Coker, 1996). Unlike revealed preference methods, the stated preference methods assess values directly through survey methods, rather than observing actual behaviors in marketplaces. Although the use of stated preference methods for environmental valuation has been debatable, there is evidence indicating that the hypothetical responses in these surveys provide useful evidence regarding value (United States Environmental Protection Agency, 2009). There are two methods that are widely used under the stated preference approach: contingent valuation and choice experiments. In theory, the contingent valuation method would be used to estimate the total change in an environmental good, while a choice experiment is capable of valuing multidimensional environmental changes (Pearce et al., 2006).

2.2 Choice experiment method

A choice experiment is a survey method that involves asking people to state their preference for hypothetical alternative scenarios, goods, or services, which are combinations of attribute levels generated by experimental design. Each alternative "good" is described by several attributes in terms of different attribute levels. One of the attributes is the price of the alternative. We use the discrete choice model to analyze how people make choices. Most environmental goods are composite, made up of a variety of attributes that can be provided at various levels. This allows the estimation of the relative importance of multiple environmental attributes and their levels, unlike contingent valuation, which cannot be used to distinguish the value of each attribute in multi-attribute environmental goods (Seenprachawong, 2016).

2.3 The basis of the choice experiment model

In the choice experiment approach, Lancaster's characteristics theory of value and the random utility model form the basis for model estimation. First, Lancaster's theory of demand states that "the total utility gained from a product or service is the sum of the individual utilities provided by the attributes of that good" (Lancaster, 1966). Second, the random utility model provides the theoretical framework for analyzing the data from a choice experiment exercise. The choice of an alternative (one of three scenarios in the choice experiment) represents a discrete choice from a set of alternatives. Discussing the random utility model, Seenprachawong (2016) states that each alternative is represented by an indirect utility function that contains two components: a deterministic component (V_i) and a random component (ε_i), which represent unobservable influences on individual choice. The overall utility of alternative i is shown as

$$U_i = V_i + \varepsilon_i \qquad (1)$$

An individual will choose alternative i if $U_i > U_j$ for all $j \neq i$. However, because the utilities include a random component, one can only describe the probability of choosing alternative i as:

$$Prob\ \{i\ is\ selected\} = Pr\ \{\ V_i + \varepsilon_i\ > V_j + \varepsilon_j\ ;\ \forall j \in C\ \} \qquad (2)$$

where C is the set of all possible alternatives. In the choice experiment, V_i contains attributes of the situation and there are three alternatives (status quo, plan A, and plan B). McFadden (1974) showed that if the error terms in equation (2) are independently and identically distributed with a type I extreme value distribution (a Gumbel distribution), then the probability of choosing alternative i has the following closed-form representation:

$$Prob\ \{i\ is\ selected\} = \frac{e^{\lambda V_i}}{\sum_{j \in C} e^{\lambda V_j}} \qquad (3)$$

This distribution is characterized by a scale parameter λ (inversely proportional to the variance of the error term) and a location parameter δ. In practice, the distribution chosen is the standard Gumbel distribution with λ=1 and δ=0 (Ben-Akiva and Lerman, 1985). McFadden's model is known as the conditional logit model. An estimated linear-in-parameters utility function for alternative i often takes the form:

$$V_i = \alpha_i + \sum_{j=1}^{n} \beta_j X_j + \sum_{k=1}^{m} \gamma_k \alpha_i Z_k \qquad (4)$$

where α_i is an alternative specific constant, X_j is the ecosystem attributes associated with the alternative, Z_k is a vector representing individual characteristics, and $\alpha_{i,}$ $\beta_{j,}$ and γ_k are parameters. Individual characteristics can be included in the model by interacting them with the alternative specific constants (as shown in equation (4)) and /or the attributes (not shown). All ecosystem attributes are entered into the model using effect codes (the utility of the average quality level is the negative sum of the utilities of the good and excellent quality levels).

Welfare estimates are obtained in choice experiment studies using the following general formula described by Hanemann (1984):

$$CV = \frac{1}{\mu}\left[\ln \sum_{i \in C} e^{Vi1} - \ln \sum_{i \in C} e^{Vi0}\right] \qquad (5)$$

where μ is the marginal utility of income; V_{i0} and V_{i1} represent the indirect observable utility before and after the change under consideration, respectively; and C is the choice set. When the choice set includes a single before and after policy option, equation (5) reduces to:

$$CV = \frac{1}{\mu}\left[V_{i1} - V_{i0}\right] \qquad (6)$$

From equation (6) it is easily seen that for a linear utility function, the marginal rate of substitution between two attributes is simply the ratio of their coefficients (Hensher and Johnson, 1981), and that the marginal WTP for a change in attribute is given by

$$MWTP_j = -\beta_j / \mu_j \qquad (7)$$

3. Study area and methods

3.1 Description of the Bang Kachao Green Area

Bang Kachao is located in Phra Pradaeng district, Samut Prakan Province, in the southern part of Bangkok, covering an area of 21.10 square kilometers within the Chao Praya river basin. It comprises six sub-districts; Song Khanong, Bang Yo, Bang Kachao, Bang Krasop, Bang Namphueng and Bang Ko Bua. Fig. 1 shows the location, with the Chao Praya River (a total length of 17 kilometers) surrounding the oval-shaped green area of Bang Kachao (Sukawattanavijit and Pricharchon, 2015).

Insert Fig. 1 here

The ecological structure of Bang Kachao comprises four main types. The first type is a rehabilitation forest that includes five habitats, namely moist evergreen forest, dry evergreen forest, beach forest, freshwater swamp forest, and abandoned orchard. Home-garden agroforestry, in which traditional farmers cultivate mixed fruit and native tree species, is the second type. The third comprises mangroves found along the riverbanks. The final type comprises the Sri Nakhon Khuean Khan Park and Botanical Garden. Thus, Bang Kachao is ecologically important and contributes significant ecosystem services to sustain urban society.

There were several attempts to protect the green area and sustain its benefits, particularly in 1982 when HM King Bhumibol Adulyadej viewed the green space from an airplane and recommended that Bang Kachao should be protected as the main source of oxygen that reduces industrial air pollution generated from Samut Prakan province. Consequently, the government developed the Sri Nakhon Khuean Khan Park to protect and restore the designated green areas for ecological and recreational benefits. Meanwhile, the Royal Forest Department (RFD) has been undertaking restoration and tree planting projects in 10 percent of the area (Sommeechai et al., 2018).

However, as a result of urbanization, the quality of this urban green area and the provisioning of its ecosystem services have been affected. The area of Bang Kachao has decreased through land use changes. Between 1996 and 2006 about 1.5 square kilometer or 7.11 percent of the total area was transformed from mixed orchards to residential areas. The reduction of green areas causes social disorder from pollution, including stress and health problems (Sukawattanavijit and Pricharchon, 2015).

Bang Kachao was selected for the study because it is the main source of clean air for Bangkok city and provides unique food products, recreational benefits for the public. Another reason for selecting this area is that there have been several attempts to protect this green area, especially with strong community participation in forest conservation. Private sectors such as banking institutions, the hospitality industry, and the manufacturing industry have also supported funding to protect Bang Kachao's green areas in the forms of Corporate Social Responsibility (CSR) (Ljubas et al., 2017). Thus, it is important to understand the possibility of implementing a PES scheme in this green area in order to enhance the integrity of ecosystem services provided while supporting people's likelihood.

3.2 Choice experiment survey

This study focused on the welfare estimates of improving ecosystem services provided by the Bang Kachao Green Area and employed a choice experiment method to estimate the value

of, or so called WTP for, quality changes of different ecosystem service attributes in the green area. It is assumed that the current quality of ecosystem services in Bang Kachao is at a status-quo level (no change). Respondents will be presented with two new restoration plans (Plans A and B) for the Bang Kachao Green Area. The new plans will ensure that the ecosystem services will be managed at higher quality levels (good and excellent). Each plan is defined using four ecosystem attributes and the price attribute. In summary, there were four main steps in the choice experiment survey: selecting attributes and attribute levels, creating choice sets, designing the questionnaire and pretesting, and conducting the survey.

Firstly, the attributes of the Bang Kachao Green Area restoration scenarios were selected from prior research and after discussions with experts. Five attributes including the payment or price attribute were selected. The first attribute was food products, a proxy for consumptive use, provided by agricultural areas and mixed fruit orchards within the Bang Kachao area. The second attribute was air quality as a proxy for indirect use or regulating service provided by the green area. The third attribute, recreational amenity, is a proxy for recreational use, including the scenic view of the area and its attractiveness to tourists and visitors. The fourth attribute was bird species richness as a proxy for non-use value or existence value. All four attributes comprise three different levels (no change, good, and excellent), which were defined as a 0 percent, 25 percent, and 50 percent enhancement, respectively. These attribute levels were similar to those included in Seenprachawong (2016). The last attribute was a monetary attribute representing a one-year voluntary donation to the Bang Kachao Restoration Fund that would be managed by an independent and trustworthy body. The payment varies between 100 Baht (USD2.9), 200 Baht (USD5.8), 500 Baht (USD14.4), and 1,000 Bath (USD28.9). The selected attributes and their levels are presented in Table 1.

Insert Table 1 here

The second step is to combine the selected attributes and levels into several choice sets. The full factorial experimental design produces L^{AC} possible combinations, where C is the number of alternatives and each alternative has A attributes with L levels. However, this produces so many alternatives requiring respondents to choose among them would be cumbersome and intellectually demanding. Thus, the fractional factorial and orthogonal design in SPSS were used to obtain 40 alternatives (Plan A). Then, a cyclical design was applied as an extension of the orthogonal approach. Thus, each choice set provided 3 scenarios: The first option is always the status quo or the base alternative; Plan A consists of one of the 40 alternatives; and Plan B is created by increasing one level in each attribute in Plan A. The 40 choice sets were

subsequently split into 10 blocks of 4 choice sets, which were assigned to ten versions of the questionnaire.

Subsequently, ten different versions of the questionnaire were created. Each version contains three sections. Every questionnaire version comprises the same information for Sections A and B but there is a difference in Section C. Section A is used to collect the socio-economic characteristics of respondents. Section B is designed to obtain information regarding the respondent's environmental concerns, experiences, and expectations of the Bang Kachao Green Area. The last section is Section C, the choice experiment and comprises four choice sets with three alternatives in each set. An example of a choice set is presented in Fig. 2. With the consideration of all attributes and a hypothetical payment, respondents were asked to choose which option they think would be the best plan for the Bang Kachao Green Area and the one they most preferred. Thus, when individuals make their choices, they implicitly make trade-off between the levels of the attributes in the different alternatives presented in a choice set. Next, a pilot study was conducted with 45 respondents to ensure that there was no problem with the survey and to obtain prior estimates for the experimental design used in the main survey.

Insert Fig. 2 here

The final step is administering the survey based on a face-to-face interview; this was conducted between July and September 2016 in five famous public parks in Bangkok and the metropolitan area, namely Sri Nakhon Khuean Khan Park; Lumpini Park; Chatuchak Park; Suan Luang Rama 9 Park; and Sri Nagarindra Park. Respondents were randomly allocated to one of the 10 blocks (questionnaire versions). The most important part is Section C, the choice experiment questions. In this section, respondents were presented a set of four choice sets. In a given choice set, each respondent was asked to choose his/her most preferred option from three options: two plan options and one status quo option. As each one had four independent choice tasks in total, a total of 200 interviews generated 800 observations (200x4).

In order to code the data from the choice experiment section, effect codes were set up following Louviere (1988). The effect codes translate category-rating scales to a coding system that can be used in econometric analysis. The effect codes used in for the food products attribute correspond to FE (excellent food products), FG (good food products). The coefficients on FE and FG provide the "marginal utility" of these levels of the attributes, while -1 times the sum of these coefficients provide the marginal utility of the average level of food products. Effect codes for three other attributes (air quality, recreational amenity, and bird species richness) were coded in the same way.

3.3 Choice experiment modeling and WTP estimation

Using data collected from 200 face-to-face interviews in the Bangkok metropolitan area and LIMDEP 9.0 software, we analyzed a conditional logit model. The discrete choice experiment method was employed to find the factors affecting WTP in each alternative consisting of different attribute levels.

According to the choice experiment model, ecosystem service attributes were classified into three hypothetical options for the respondents to choose their most preferred option. This information was used to indicate the importance of the attributes. The monetary and respondent characteristics were also included in the conditional logit model so that we could estimate the WTP for improving the quality of the ecosystem services by maximizing the likelihood function. Subsequently, we estimated the WTP for restoring the green area. We also examined socio-demographic variables affecting the preferences.

4. Results

4.1 Respondents' profile

The data consisted of 200 completed interviews. The majority of the respondents (60.5%) were women and over half of the total respondents (54.5%) were married. People of all ages between 19 and 70 were interviewed, but young people of between 26 and 35 represented one-third of the respondents. The average age is 38 years and the average number of years of education is 15.41 (bachelor degree). Almost half of the respondents (46.5%) are civil servants, while 37.5% are employees, and 9.5% are self-employed. Only 5% and 1.5% were found to be students and retirees, respectively. The average monthly income of respondents is 20,800 Baht (USD600) while the average household income is 51,000 Baht (USD1473) per month. Most respondents have an average number of family members of 3-4 people. Forty-four percent of the respondents were found to live in Bangkok; the others live in the surrounding provinces of Samut Prakan, Nonthaburi, Pathum Thani, and Samut Sakhon, accounting for 32%, 13%, 6%, and 5%, respectively. These respondents' information was used to determine if any particular characteristics were associated with the preference and willingness to pay for Bang Kachao's ecosystem services.

4.2 Environmental concern, experiences, and expectations of the Bang Kachao Green Area

In Section B of the survey, a list of questions associated with environmental concerns in general, including the experiences and expectations of respondents was asked. These questions seek to understand the motives of the respondents for supporting the protection of Bang Kachao. Firstly, respondents were asked to specify environmental problems, which they considered to be the most important in Thailand. Thirty-six percent of respondents believed that deforestation was the most serious environmental issue in the country. Nearly 13.5% of the respondents were concerned about air pollution. The percentage of the respondents who concerned about the problems of drought, water pollution, global warming, and biodiversity loss were found to be similar, representing 12.5%, 11.5%, 10.5%, and 9%, respectively. Only 4%, 2% and 1% of the respondents believed flooding, mangrove degradation, and solid waste to be important issues, respectively.

Next, respondents were asked if and how often they had visited Bang Kachao for the last five years. Fifty-six percent of respondents stated that they had visited the Bang Kachao Green Area at least once before the study was conducted. Among those, thirty-five percent had visited the area 2-3 times, thereby suggesting that most respondents are familiar with the area and that at least one third appreciated the area enough so that they made repeat visits. For those who used to visit the area, they reported that they have used the area for recreational activities such as walking, biking, bird watching, and buying traditional food and fruits. While some residents reported that they have received income from tourists and agricultural products. Although only half the respondents had visited Bang Kachao, most of them (88.5%) perceived that they had gained benefits from this green area, especially air purification (67%). Lastly, when we asked if they would like to visit Bang Kachao within the next five years, ninety percent of the respondents reported they would like to visit the Bang Kachao Green Area.

4.3 Conditional logit model

For the analysis, we restricted the sample to those respondents who did not serially choose the status quo option; this left a sample size of 200 respondents. The discrete choice and conditional logit model were estimated using the LIMDEP 9.0 Software. The magnitude and signs of the coefficients are presented in Table 2. They are in line with expectations, especially that the coefficient on cost is negative and significant, meaning respondents prefer lower costs. In particular, respondents show a strong preference for a better level of all attributes: food products; air quality; recreational amenity; and bird species richness. The coefficients on air quality are significant and positive as expected for both levels, good and excellent. Whereas the coefficient estimates for food products, recreational amenity, and bird species richness are positive and significant for the excellent level. This means that respondents value the excellent level of these

attributes over other attribute levels. In other words, most respondents prefer an excellent level to a good level. However, the coefficient estimate for the excellent level of bird species richness is only significant at the 10% level and remains the lowest value. Moreover, the age of respondents is the single socioeconomic factor influencing the WTP for restoring the green area; however, the coefficient is negative and significant (at 10% level).

Insert Table 2 here

4.4 Willingness to Pay

Exception for the significance and relative size, the implication of the coefficient values presented in Table 2 is not straightforward. We need to compute the marginal rates of substitution between the attributes using the coefficient for the cost as numeraire (Hanemann, 1984). Thus, we can interpret the ratios as average marginal WTP for a change in each attribute. The results are presented in Table 3.

Insert Table 3 here

Then, using equation (6) we estimate the welfare implications of moving from the status quo (no change) to non-status quo (good and excellent) as the compensating variation (CV) (Hanemann, 1984). Therefore, the CV for enhancing food products from the status quo to excellent is 207- (-207) or 414 Baht/person/year. The CV for improving air quality from the status quo to excellent is 255- (-347) or 602 Baht/person/year and from the status quo to good is 92- (-347) or 439 Baht/person/year. The CV for enhancing recreational amenity is 127- (-127) or 254 Baht/person/year. In addition, the CV for enhancing bird species richness is equal to 83- (83) or 166 Baht/person/year. Thus, the average WTP for restoring the ecosystem services of the Bang Kachao Green Area was 1,436 Baht (USD41.5) per person per year. The highest estimated WTP figure is for an excellent level of air quality followed by a good level of air quality, an excellent level of the food product; an excellent level of recreational amenity; and an excellent level of bird species richness (USD17.3, USD12.7, USD12, USD7.3, USD4.8), respectively. The average WTP estimates are as shown in Table 4.

Insert Table 4 here

5. Discussion and conclusion

This study used a choice experiment in estimating the economic value of changes to the quality of ecosystem services provided by the Bang Kachao Green Area. The ranking of the WTP estimates suggests that respondents have a higher preference for enhancing the air quality features followed by the food product attribute and the recreational amenity attribute when compared with the bird species richness attribute. We believe this indicates that residents in Bangkok are strongly concerned about air pollution in the city. Therefore, among the ecosystem services investigated in this study, the most significant need of the urban respondents is enhancing air quality. While the existence of bird species is not perceived as being important as the other services. One possible interpretation of these results is that because it represents non-use value. This finding is consistent with the result found by Konijnendijk et al. (2005) that indicates that the non-use values (option, bequest, existence) have been considered less significant for urban forest ecosystems.

The total WTP estimate of improving ecosystem services in Bang Kachao was found to be USD41.5 per person per year and the total annual for the entire population of the Bangkok Metropolitan Region, 10.77 million people was about USD446.7 million. When contrasting the results to results from previous choice experiment studies, we observe some differences. For instance, the total value of USD41.5 is less than the estimated WTP for enhancing coastal ecosystem services in Phangnga Bay, southern Thailand, which was estimated to be 2,263 Baht (USD65) per person per year (Seenprachawong, 2016). However, we observe that the WTP for enhancing bird species richness, which is a non-use benefit, remains the last order of magnitudes as those calculated by Seenprachawong (2016). Moreover, the WTP for the 25% and 50% increase in clean quality were found to be USD12.7 USD17.3 per year While Yoo et al. (2008) found that the houhouseholds' WTP for a 10% reduction in the concentrations of major air pollutants in Seoul was found to be approximately USD55.2 per year. One interpretation for these results is that the WTP for the clean air of the urban dwellers in Bangkok is lower than the WTP of those who live in developed countries like Korea.

It was perceived that the age of respondents is the single socioeconomic factor negatively influencing the WTP for restoring the green area. Thus, one possible interpretation of this result is that younger people are more likely to pay for a better quality of ecosystem services provided by the green area. This result is in line with previous research, which found that old people are being less likely to pay for visiting urban green spaces (Caula et al., 2009; Lo and Jim, 2010; Lepez-Mosquera and Sanchez, 2011). However, this result presents the opposite sign compared to the result shown by Sirina (2017). Moreover, this study did not find evidence indicating income has a statistically significant influence on Bangkok residents' preferences regarding the ecosystem service attributes in Bang Kachao. This result is similar to the case of Korean dwellers (Koo et al., 2013), which implies that urban forests are an essential good for everyday

life in Korean cities.

This case study contributes to the limited literature about the public preference for urban forest restoration that involves the conservation of excising green spaces in Thailand and other regions. Our study provides useful information for policymakers, as it established which types of ecosystem services are more important to urban dwellers or should be given priority. We found that respondents considered enhancing air quality was the most important ecosystem service provided by the Bang Kachao Green Area. It was followed by food production, recreational amenity and bird species richness. These results suggest that the government should take immediate steps to establish a restoration project with the concrete objective of increasing green areas for air purification. For this purpose, flood-tolerant species such as mangrove and swamp plants should be promoted and planted, more especially in the exiting mangroves along the riverbanks (Leksungnoen et al., 2017).

However, preferences for food products, recreational amenities, and bird species richness must be considered together with the air purification benefit. This is because our results indicate that Bang Kachao is increasing valued due to its regulating, provisioning, recreational, and supporting benefits and the respondents favor restoration projects that involve improving all services from the status quo to the excellent level (50% increasing). Therefore, policies enhancing the level of food products, recreational amenities, and bird species richness are also needed. We suggest that traditional agricultural practices (mixed fruit orchards) and agroforestry should be utilized for providing agricultural products. It is necessary to encourage traditional farmers to plant more native and fruit trees in their home gardens as part of the agroforestry system. This form of agriculture could become an eco-tourist initiative and increase income for local people. Furthermore, although the results likely reflect the fact that the use values associated with the green area retrieved higher welfare estimates than non-use values, the non-use value is also important in adding value to ecosystem services. Therefore, promoting the understanding of supporting services and providing evidence of this benefit to urban society and individuals remains necessary for preserving biodiversity in the urban forests (Levesley et al., 2016).

Finally, the study results indicate that there is potential for implementing PES schemes to improve ecosystem service in this green area. For instance, Bangkok users could support local communities to maintain their traditional mixed fruit orchards and green areas; these incentives could be implemented through voluntary payments, voluntary works, and ecotourism activities (Wunder, 2007). More specially, young people should be encouraged to participate in the restoration projects or PES schemes as the estimated WTP was found to be significantly positive among younger respondents. Thus, our findings may be helpful to decision-makers in the preparation of urban forest management plans and market-based mechanisms that fulfill the

requirements of the citizens without ignoring the ecological and supporting functions of the urban green areas.

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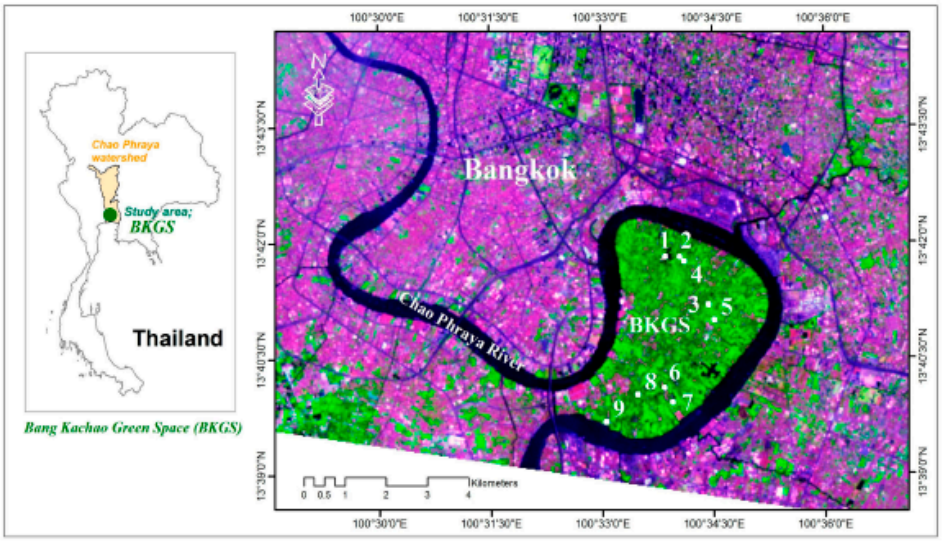


Source: Sommeechai et al., (2018)

Fig. 1. Satellite LANDSAT7 false color image showing the location of the Bang Kachao Green Area

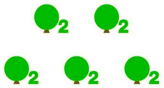
Given the following the Bang Kachao's restoration plans, which one do you prefer? A cost will be entailed upon you if you choose either plan. However, no payment would be required for "No restoration plan" option, but the condition of ecosystem services would not be improved in the food product, air quality, scenic view and bird species attributes.			
Attribute	**Status quo** (No restoration plan)	**Plan A**	**Plan B**
Food Products	No change 	Good  25% increase	Excellent  50% increase
Air Quality	No change 	Good  25% improvement	Excellent  50% improvement
Recreational amenity	No change	Excellent	No change
Bird Species Richness	No change 	No change 	Good   25% increase
One Time Payment (Bath)	0	100	200
Please choose the most appropriate			

Fig. 2. Example of a choice set from a questionnaire

Table 1

The attributes and attribute levels used in the study

Attribute	Level
Food Products (F)	Status quo: no change
	Good: 25% increase in the quantity of food products from agricultural area and mixed fruit orchards within Bang Kachao area.
	Excellent: 50 % increase in the quantity food products agricultural area and mixed fruit orchards within Bang Kachao area.
Air Quality (A)	Status quo: no change
	Good: 25% improvement in the air quality
	Excellent: 50 % improvement in the air quality
Recreational amenity (R)	Status quo: no change
	Good: 25% increase in the scenic view
	Excellent: 50 % increase in the scenic view
Bird Species Richness (B)	Status quo: no change
	Good: 25% increase in the number of bird species
	Excellent: 50 % increase in the number of bird species
One Time Payment (Cost)	0, 100, 200, 500, 1,000 Baht

Table 2

The coefficient estimates for the Conditional Logit Model resulting from the analysis of LIMDEP software

Variable	Coefficient	T statistic	P value
CONSTANT	0.4300	0.5690	0.5691
COST	-0.0015	-9.3280	0.0000**
FE	0.3198	4.5930	0.0000**
FG	-0.0547	-0.8030	0.4222
AE	0.3931	5.8840	0.0000**
AG	0.1413	2.0550	0.0399**
RE	0.1955	2.9050	0.0037**
RG	-0.0036	-0.0520	0.9584
BE	0.1276	1.8670	0.0618*
BG	-0.0718	-1.0380	0.2993
MALE	-0.0922	-0.4670	0.6408
AGE	-0.0171	-1.7400	0.0819*
INC	-0.4188	-0.5080	0.6116
EDU	0.0247	1.2930	0.1961
Log-likelihood		-807.69	
No. of respondents		200	
No. of observation		800	

** Significant at 5%

* Significant at 10%

Table 3

Marginal WTP for a change in each attribute

Attribute	(Baht/person/year)		
	Status quo	Good	Excellent
Food product	-207	-	207
Air quality	-347	92	255
Recreation attractiveness	-127	-	127
Bird species richness	-83	-	83

Table 4

Welfare estimates of moving from status quo to non-status quo

Ecosystem Services	WTP (Baht/person/year) (%)
Air quality (indirect use value)	602 (42%)
Food products (consumptive use value)	414 (29%)
Recreation amenity (non-consumptive use value)	254 (18%)
Bird species richness (non-use value)	166 (11%)
Total	1,436 (100%)

USD1=34.63 Baht (2016/09/01)